PROBLEM AND OBJECTIVE NARRATIVES

(from September 14, 1995 workshop)

B-000666

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WATER SUPPLY PROBLEMS

The problems of water supply associated with the Bay-Delta system can be divided into ~~two~~ three basic categories: conflict among beneficial uses, ~~and~~ economic impact, and Water Quality (Water Quality Problems are described separately). If there were no conflict among competing beneficial uses, only hydrology would constrain exports or out-of-stream uses. The identified problems can be measured in two ways: adequacy of supply and predictability of supply. In turn, shortfalls or uncertainty are manifest in economic impacts.

The adequacy of a supply is the degree to which supply and demand are matched. There is a mismatch between Bay-Delta water supply quantities and current demand patterns. Mismatches between supply and demand generally cause problems, both for water users and the environment. The predictability of a supply is the degree to which we can accurately predict supply or supply patterns in the future. Unpredictable supplies cause problems because they increase the likelihood that we will either overinvest in water supply (e.g., build unnecessary storage), under invest in production (e.g., plant too few acres) or suffer unacceptable shortages.

In turn, problems with adequacy and predictability can be viewed from either planning or operational perspectives. An operational perspective looks at current water conditions and tries to project water supply patterns in the short-term (days, weeks, months, possibly years). A planning perspective does not look at current conditions, but attempts to define the water supply patterns that can be expected in the future over the long-term.

Finally, different end users use water differently. What is a problem for one user may not be a problem for another user. Thus, the various users of water must be considered separately. For example, urban and agricultural water users want supplies which are relatively consistent, year after year. By contrast, the environment requires variations in flows from year to year. Too many high flow or low flow years are undesirable.

Water Supply
Problem Statements

There is a mismatch between Bay-Delta water supplies and ~~Bay-Delta water supplies are insufficient to meet~~ current and projected beneficial uses dependent on the Bay-Delta system. As in stream and out-of-stream water ~~demands~~ needs have grown, water shortages for all the uses have become larger and more frequent and water supplies have grown less predictable. This water reliability problem is projected to become more acute over time.

The major problems can be categorized as follows:

A. ~~**Bay-Delta system water supply quantities and timing do not meet short- and long-term beneficial use needs.**~~ Conflicts between beneficial uses and system inefficiencies reduce the utility of the Bay-Delta system for water management.

1. The Bay -Delta system supplies do not meet the short- and long-term **in-Delta** beneficial use needs.

   a. **In-Delta short-term water supplies** in some locations do not meet needs in water short periods for the following two users:

      a.1. ~~Water supply quantities and timing do not meet short-term~~ Lowered water levels limit access to water for (existing and future) **agricultural water needs during some periods.**

      a.2. Water supply ~~quantities~~ and timing do not meet short-term **environmental water needs** (see Ecosystem Quality section).

   b. The Bay-Delta system water supplies in some locations are inadequate to meet **projected long-term in-Delta** needs for the following three users:

      b.1. ~~Water supply quantities and timing do not meet~~ Lowered water levels impact access to water for long-term (existing and future) **agricultural water needs.**

      b.2. Water supply ~~quantities~~ and timing do not meet long-term (existing and future) ~~**urban**~~ **municipal and industrial water needs.**

      b.3. Water supply ~~quantities~~ and timing do not meet long-term **environmental water needs** (see Ecosystem Quality section).

2. Bay-Delta **system export water supply** ~~quantities~~ and timing do not meet short- and long-term needs and the opportunities for ~~transferring~~ transporting additional water across the delta are limited.

   a. **Short-term export water supplies** do not meet needs ~~in water short periods~~ for the following three users:

      a.1. Water supply ~~quantities~~ and timing for export do not meet short-term (existing and future) **agricultural water needs.**

      a.2. Water supply ~~quantities~~ and timing for export do not meet short-term (existing and future) ~~**urban**~~ **municipal and industrial water needs.**

a.3 Water supply ~~quantities~~ and timing for export do not meet short-term **environmental water needs** (see Ecosystem Quality section).

b. The Bay-Delta system water supplies are inadequate to meet projected **long-term export water needs** for the following three users:

b.1. Water supply ~~quantities~~ and timing for export do not meet long-term (existing and future) **agricultural water needs**.

b.2. Water supply ~~quantities~~ and timing for export do not meet long-term (existing and future) ~~**urban**~~ **municipal and industrial water needs**.

b.3. Water supply ~~quantities~~ and timing for export do not meet long-term **environmental water needs** (see Ecosystem Quality section).

3. Available water does not meet short-and long-term expected needs for **Delta outflow**; (see Ecosystem Quality and Water Quality sections).

B. **Bay-Delta system water supplies are uncertain** with respect to short- and long-term needs as shown below:

1. The water supply in and from the Bay-Delta system is unreliable due to the **vulnerability of the levees** that protect ~~it~~ the Delta water transport system. (See Vulnerability of Delta Functions Section).

2. The ~~amount of water~~ water supply available from the Bay-Delta system from season to season and from year to year **cannot be predicted** with desired certainty.

a. The ~~amount of water~~ water supply available from the Bay-Delta system over the **short-term** cannot be predicted with sufficient certainty for the following three water users:

a.1. **Agricultural water** ~~users~~ suppliers cannot plan and manage for efficient water use due to the unpredictability of the water supply available in the coming season.

a.2. **Municipal and Industrial** ~~**Urban**~~ **water** ~~users cannot~~ suppliers must plan and manage for possible interruption of efficient water use due to the ~~unpredictability of the~~ water supplies. ~~available in the coming season.~~

a.3. **Environmental water** users cannot plan and manage for efficient water use due to the unpredictability of the water supply available in the coming season; (see Ecosystem Quality section)

b. ~~The amount of~~ water the Water supply available from the Bay-Delta system over the **long-term** cannot be predicted with sufficient certainty for the following three water users:

b.1. Long-term regional planning for **agricultural water** supply cannot be conducted with sufficient certainty due to the unpredictability of available Bay-Delta system water supply.

b.2. Long-term regional planning for ~~**urban**~~ **municipal and industrial water** supply ~~cannot be conducted with sufficient certainty due to~~ must include the unpredictability of unreasonable ranges of water supplies available from Bay-Delta system ~~water supply.~~

b.3. Long-term regional planning for **environmental water** supply cannot be conducted with sufficient certainty due to the unpredictability of available Bay-Delta system water supply; (see Ecosystem Quality section)

Water Supply
Objective Statements

~~Improve the ability of the Bay-Delta system to meet current and projected water supply beneficial uses.~~ Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.

A. ~~Improve the adequacy of Bay-Delta system water supply quantities and timing to help meet reasonable short- and long-term beneficial use needs.~~ Reduce the conflict between beneficial water users and improve the ability to transport water through the Bay-Delta system.

1. Maintain adequate Bay -Delta system supplies to meet the short- and long-term **in-Delta** beneficial use needs.

   a) Maintain or provide adequate **in-Delta short-term water supplies** in water short periods for the following two users:

      a.1) ~~Maintain water supply quantities and timing that meet~~ Improve access to water for short-term expected (existing and future) **agricultural water needs**.

      a.2) Provide water supply ~~quantities~~ and timing that meet short-term expected **environmental water needs** (see Ecosystem Quality section).

   b) Maintain or improve the adequacy of Bay-Delta system water supplies to meet **long-term** needs of in-Delta beneficial use for the following three users:

      b.1) ~~Maintain adequate water supply quantities and timing that meet~~ Improve access to water for long-term (existing and future) **agricultural water needs**.

      b.2) Maintain adequate water supply ~~quantities~~ and timing that meet long-term expected (existing and future) ~~**urban**~~ **municipal and industrial water demands**.

      b.3) Provide adequate supply ~~quantities~~ and timing that meet long-term expected **environmental water demands** (see Ecosystem Quality section).

2. Improve Bay-Delta **system export water supply** ~~quantities~~ and timing to help meet reasonable short- and long-term needs.

   a) Improve **adequate short-term export water supplies** during water short periods for the following three users:

      a.1) Water supply ~~quantities~~ and timing for export to help meet short-term (existing and future) **agricultural water needs**.

      a.2) Water supply ~~quantities~~ and timing for export to help meet short-term (existing and future) ~~**urban**~~ **municipal and industrial water needs**.

      a.3) Water supply ~~quantities~~ and timing for export to help meet short-term **environmental water needs** (see Ecosystem Quality section).

b). Provide Bay-Delta water supplies that are adequate to help meet **long-term export water projections** of beneficial use need for the following three users:

b.1) Water supply ~~quantities~~ and timing for export to help meet long-term (existing and future) **agricultural water needs**.

b.2) Water supply ~~quantities~~ and timing for export to help meet long-term (existing and future) ~~**urban**~~ **municipal and industrial water needs**.

b.3) Water supply quantities and timing for export to help meet long-term **environmental water needs** (see Ecosystem Quality section).

3. Improve the adequacy of Bay-Delta water to meet short-and long-term expected needs for **Delta outflow**; (see Ecosystem Quality section).

B. **Reduce the uncertainty** of Bay-Delta system water supplies to help meet short- and long-term needs as shown below:

1. Improve the reliability of the Bay-Delta system by reducing the **vulnerability of the levees** that protect it (see Vulnerability of Delta Functions Section).

2. **Improve the Predictability** of the ~~amount of water~~ water supply available from the Bay-Delta system from season to season and from year to year.

a) Improve the predictability of the ~~amount of water~~ water supply available from the Bay-Delta system over the **short-term** for the following three water users:

a.1) Improve predictability for **agricultural water** supplies for planing and management for efficient water use in the coming season.

a.2) Improve predictability for ~~**urban**~~ **municipal and industrial water** supplies for planing and management for efficient water use in the coming season.

a.3) Improve predictability for **environmental water** supplies for planning and management for efficient water use in the coming season; (see Ecosystem Quality section)

b) Improve the predictability for the ~~amount of water~~ water supplies available from the Bay-Delta system over the **long-term** for the following three water users:

b.1) Improve long-term predictability for **agricultural water** supplies.

b.2) Improve long-term predictability for ~~**urban**~~ **municipal and industrial water** supplies.

b.3) Improve long-term predictability for **environmental water** supplies. (see Ecosystem Quality section)

ECOSYSTEM QUALITY PROBLEMS

The Bay-Delta system no longer supports a broad diversity of habitats nor the and habitat quality necessary to ensure those ecological functions necessary to sustain healthy populations and communities of plants and animals. For that reason the problem statements are expressed in terms of limitations in important habitats of desirable plant and animal species that use the Bay-Delta ecosystem for at least a portion of their life-cycles. Some species reside in San Francisco Bay as adults and use Delta habitats for spawning and juvenile rearing (e.g., longfin smelt). Other species (e.g., salmonids) spawn upstream of the Delta and reside as adults in the Pacific Ocean but must travel through the Delta and Bay during juvenile outmigration and adult inmigration. Limitations in Delta habitat affect these and other species in various ways.

The CALFED Bay-Delta Program seeks to use an ecosystem approach to fixing habitat problems in the Bay-Delta ecosystem. An ecosystem approach entails addressing the underlying causes of ecosystem degradation through protecting, enhancing, and restoring important habitats.

Important species of fish, animals, plants, and other life-forms are identified in the problem statements as examples of the organisms adversely affected by the named habitat problems. The health and sustainability of individual species and species communities residing in the Delta or Bay will be used as health indicators to judge the success of the CALFED Bay-Delta Program in resolving habitat problems. The evidence shows that better habitat generally leads to more abundance of species. For example, recovery of populations of resident species (e.g. Delta smelt) and anadromous species (e.g. Chinook salmon) that use the Delta would indicate that improvements to Delta habitats had been successful.

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Ecosystem Quality
Problem Statements

The Bay-Delta Ecosystem does not support high quality habitats for diverse and valuable plant and animal species. Many plant and animal species that use the Bay-Delta have experienced moderate to severe declines. The major problems for the aquatic and wetland habitats are outlined below:

A. **Important Aquatic Habitats** are inadequate to support production and survival of native and other desirable estuarine and anadromous fish in the estuary. Examples of fishes that have experienced declines related to changes in Delta habitat include delta smelt, longfin smelt, Sacramento splittail, Chinook salmon, striped bass, and American shad. The problems for specific aquatic habitats include:

1. **Lack of Shallow Riverine Habitat** limits spawning success and early survival of many estuarine and anadromous fish in the estuary. Examples of affected species include Sacramento splittail, Chinook salmon, striped bass, delta smelt, American shad.

   a) **Lack of Riverine Edge Habitats** limits spawning success and survival of juveniles of many fish species that use such habitats for spawning and rearing (e.g., Sacramento splittail, delta smelt, Largemouth Bass, and Chinook salmon).

   b) **Lack of Shallow Shoal Habitat** within the main channels of the Delta and upper Bay limits shallow foraging habitat for juveniles of many estuarine fish (e.g., Sacramento splittail, striped bass, delta smelt, longfin smelt, starry flounder, and white sturgeon).

2. **Lack of Shaded Riverine ~~Aquatic~~ Habitat** limits growth and survival of estuarine resident and anadromous fish in the estuary (e.g., Sacramento splittail, Chinook salmon, and tule perch).

   a) **Lack of Riparian Woodland** limits cover and terrestrial food production for Delta fish.

   b) **Lack of Large, Woody Debris** along Delta levees limits feeding and refuge habitat for juvenile and adult fish in the Delta.

   C) Lack of Shaded Habitat results in elevated water temperatures.

3. Reduced quality ~~Lack~~ **of Tidal Slough Habitat** limits the fish-production capacity of the Delta (e.g., delta smelt, Chinook salmon, striped bass, Sacramento splittail, and Tule Perch and copepods).

   a) ~~Lack of and~~ **Degradation of Dead-End Sloughs** habitat reduces areas available for spawning and rearing of some native resident fish species.

   ~~b) Lack of Open-Ended Sloughs may have reduced areas available for spawning and rearing of some fish species.~~

   b) **Abundant Water Hyacinth** may limit productivity of tidal slough habitats.

   c) Primary biological production ~~energetic Exchange~~ during tidal cycling is limited by lack of tidal slough habitat.

4. **Springtime Upstream Relocation of Estuary Entrapment/Null Zone Habitat** by low Delta outflow limits production of fish and their prey in the estuary (e.g., delta smelt, longfin smelt, and striped bass).

   a) **Saltwater Intrusion into Suisun Bay** reduces the bay's value as a low-salinity nursery are

   b) **Low Salinity (less than 10 ppt) Habitat** is confined to deeper channels in the Western Delta where it is of limited value as compared to Suisun Bay.

   c) **Brackish Water (1 to 25 ppt) Habitat** occurs less frequently in San Pablo Bay with reductions in Delta outflow during the winter and spring which may limit production of bay species such as bay shrimp, starry flounder, Pacific herring, and dungeness crab.

5. **Reduced and Altered Transport Flows** hinder successful movement of larval and juvenile fish from spawning habitats to nursery habitats in the Delta and Bay (e.g., ~~delta smelt,~~ longfin smelt, striped bass, Chinook salmon, and Sacramento splittail).

   a) **Reduced Transport of Young Fish from the Delta to Suisun Bay** nursery areas because of low Delta outflow reduces growth, survival, and abundance of important estuarine fish. (e.g., striped bass and delta smelt)

   b) **Reduced Transport of Young Fish through the Delta** to the ocean limits survival and abundance of estuarine and anadromous fish. (e.g., Chinook salmon, steelhead, and American shad).

   c) **Increased Transport of Young Fish from North to South across the Delta** and direct entrainment of fish because of high export-to-inflow ratios reduces survival and abundance of estuarine and anadromous fish (e.g., Chinook salmon, delta smelt, striped bass, steelhead, and American shad).

   d) **Local Structures** block and alter transport flows and increase predation rates (e.g., Chinook salmon).

6. **Altered Migratory Cues** disrupt upstream and downstream movement of anadromous and estuarine fish (e.g., Chinook salmon, steel head, and white sturgeon).

   a) **Upstream Migration of Adult Salmonids through the Delta is Disrupted** by lack of olfactory cues caused by export of spawning-river water in ~~the Delta~~ and above the Delta.

   b) **Outmigration of Juvenile Fish through the Delta is Hindered** by net downstream flow cues toward South Delta export pumps (e.g., delta smelt, striped bass, American shad, and Sacramento splittail).

   c) **Upstream Migration of Adult Estuarine Fish into Delta and River Spawning Areas is Hindered** by altered net flow of water across the Delta.

7. **Reduced Food Web~~Chain~~ Productivity** in aquatic habitats limits forage availability for fish species (e.g., delta smelt, longfin smelt, Sacramento splittail, Chinook salmon, striped bass, starry flounder, bay shrimp, and neomysis)

a) **Entrainment of Food ~~Chain~~Web Productivity** by diversions limits habitat suitability for desirable fish species.

b) **High Concentrations of Toxicants** in the water column and in sediments ~~may~~ reduces production and survival of aquatic plants and invertebrates.

c) **Introduced Species** ~~consume energy and occupy~~ compete for food and habitat space with desirable species~~for important~~ organisms.

d) **Reduced Residence Time of Water** in Delta channels limits plankton blooms.

e) **Reduction in Nutrient Inputs** from wetland and riparian habitats may limit aquatic productivity.

f) **High Salinity Levels** in Delta aquatic habitats limits seasonal productivity patterns of estuarine food-chain organisms.

g) **Reduction and Seasonal Shift of Freshwater Inflow to ~~Estuary~~ the Delta** directly limits primary and secondary productivity of the estuary during critical periods.

~~h) **Lack of Shallow Water Habitats in the Estuary** directly limits primary and secondary productivity.~~

8. **Excessive Concentrations of Toxic Constituents and their Bioaccumulation** directly limits survival and growth of desirable fish species (e.g., delta smelt, longfin smelt, Sacramento splittail, Chinook salmon, striped bass, and starry flounder).

a) **Excessive Pesticide Residues** directly affect some fish and wildlife species.

b) **Excessive Hydrocarbons, Heavy Metals, and other Pollutants** directly harm some fish and wildlife species.

B. **Important Wetland Habitats** are inadequate to support production and survival of wildlife species in the Delta. The problems for the specific wetland habitats include:

1. **Lack of Brackish Tidal Marsh Habitats** of high quality limits supportable populations of wildlife species that inhabit them (e.g., Suisun Slough thistle, Suisun Song Sparrow, and Snowy Egret).

a) **Altered Vegetation Composition** in brackish marshes caused by changes in salinity levels limits habitat suitability for some species.

b) **Reduced Areal Extent and Patchiness** of brackish marsh limits wildlife populations and genetic exchange.

~~c) **Inappropriate Salinity Levels** reduces forage production and habitat suitability for some species.~~

c) **Disconnection of Supporting Habitats** such as aquatic habitats and riparian woodlands and adjacent uplands limits productivity in brackish marshes.

2. **Lack of Freshwater Habitats** of high quality limits supportable populations of native wildlife species (e.g., giant garter snake, tri-colored blackbird, and Mason's lilaeopsis).

   a) **Inappropriate Increased Salinity Levels** do not support desirable vegetation composition and thereby limit habitat suitability for some species.

   b) **Reduced Areal Extent** of high quality freshwater marsh habitats does not support sustainable populations sizes of some wildlife species.

   c) ~~**Inappropriate Juxtaposition**~~ **Lack of connection between** of freshwater marsh habitats does not provide corridors for population movement and genetic exchange.

   d) **Vulnerability of Levee Failure on Delta Islands** threatens sustainability of existing freshwater marshes.

3. **Limited Riparian Woodland Habitats** of high quality in the Delta reduces diversity and sizes of supportable native wildlife populations (e.g., Swainson's hawk, riparian brush rabbit, western yellow-billed cuckoo, neotropical migrant songbirds, and northern California black walnut).

   a) **Lack of Riparian Habitat Structure** near foraging areas limits nesting opportunities for some native bird species.

   b) **Fragmentation** of riparian habitat patches does not provide corridors for population movement and genetic exchange.

   c) **Limited Areal Extent** of riparian habitats prevents use by some native bird species.

   d) **Disconnection of Supporting Habitats** such as aquatic habitats and brackish marshes limits productivity in riparian woodlands.

4. **Reduced Breeding Waterfowl Habitats** limits production of desired populations of dabbling ducks (e.g., mallard, cinnamon teal, and wood duck).

   a) **Lack of Brood Habitat** of high quality near nesting habitat limits dabbling duck production.

   b) **Lack of Nesting Habitat** of high quality near brood habitat limits dabbling duck production.

5. **Reduction in Wintering ~~Waterfowl~~ Wildlife Habitats** for foraging and resting limits desired populations of wintering waterfowl (e.g., Aleutian Canada goose, mallard, tundra swan, white-fronted goose and shore birds).

   a) **Decreasing Waste Grain** on agricultural lands limits availability of ~~waterfowl~~ wildlife forage.

   b) **Lack of Resting Areas** near foraging areas limits wintering ~~waterfowl~~ wildlife populations that can be supported in the Delta.

   c) **Reduction in Historical Foraging Habitats** (e.g., freshwater marsh and brackish water marsh) limits availability of high quality foraging areas for wintering ~~waterfowl~~ wildlife.

d) **Vulnerability of Levee Failure on Delta Islands** threatens sustainability of some wintering ~~waterfowl~~ wildlife habitats.

6. **Lack of ~~Wintering Habitat for Greater Sandhill Cranes~~ Managed Permanent Pasture Habitat** limits wintering crane populations (e.g., lesser sandhill crane, greater sandhill crane).

a) **Lack of Foraging Habitats** of high quality for cranes in proximity to roosting habitats limits supportable wintering populations.

b) **Lack of Roosting Habitats** of high quality for cranes in proximity to foraging habitats limits supportable wintering populations.

~~7. **Lack of Connectivity among Wetland Habitats** does not provide corridors for population movement and genetic exchange.~~

7. **Restricted Flood Plains and Associated Riparian Habitat** of sufficient size and high quality in the Delta reduce the diversity and sizes of fish and wildlife populations.

a) **Lack of Suitable Flood Plains** reduces the availability of temporarily flooded spawning habitat for fish such as the Sacramento splittail.

b) **Narrow Restricted Channels** increase the risk of levee failure and subsequent catastrophic losses of wildife habitat protected by these levees.

C. **Populations of some species of plants and animals** dependent on the Delta have declined. ~~to the point that these species are endangered, threatened, or of special concern.~~

1. **Many species in the Bay-Delta system** have declined to the point that they are threatened, endangered, or species of special concern.

2. **Many species of economic importance** have declined.

3. **Some prey or food species** have declined to the point that they no longer adequately support populations of predator species.

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Ecosystem Quality
Objective Statements

Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.

A. **Improve and Increase Aquatic Habitats** so that they can support the sustainable production and survival of native and other desirable estuarine and anadromous fish in the estuary.

1. **Increase Amount of High Quality Shallow Riverine Habitat** to allow sustainable fish spawning and early rearing.

   a) **Increase Amount of Quality Riverine Edge Habitat** to allow spawning and rearing by a sustainable population of native fish species.

   b) **Increase Amount of Quality Shallow Shoal Habitat** within the main channels of the Delta and upper Bay to allow shallow foraging by a sustainable population of juvenile estuarine fish.

2. **Increase Amount of High Quality Shaded Riverine Habitat** to allow the growth and survival of sustainable populations of estuarine resident and anadromous fish in the estuary.

   a) **Increase Amount of Quality Riparian Woodland Habitat** to allow production of terrestrial food sufficient to support sustainable populations of resident and anadromous fish.

   b) **Increase Amount of Large, Woody Debris** along Delta levees to allow juvenile and adult feeding and refuge for sustainable populations of fish.

   c) Increase Amount of Shaded Riverine Habitat to provide for localized temperature reduction.

3. **Increase Amount of Quality Tidal Slough Habitat** containing emergent and submerged vegetation to support the fish-production capacity of the Delta.

   a) **Increase Amount of Dead-End Slough Habitat** to allow spawning and rearing of sustainable populations of some resident species.

   ~~b) **Increase Amount of Open-Ended Slough Habitat** to allow spawning and rearing of sustainable populations of some resident species.~~

   b) **Reduce Water Hyacinth** populations in tidal slough habitats to improve habitat quality for sustainable populations of Delta fish.

   c) **Increase Amount of High Quality Tidal Slough Habitat** to allow increased ~~energetic exchange between aquatic and terrestrial ecosystems~~. primary biological production.

4. **Increase Amount of High Quality Estuary Entrapment/Null Zone Habitat** to support sustainable

fish populations in the Delta.

a) **Reduce Saltwater Intrusion** into Suisun Bay to increase the nursery area for sustainable populations of plants and animals.

b) **Expand** the geographic extent of **Low Salinity Habitat** in Suisun Bay.

c) **Increase** the occurrence of **Brackish Water Habitat** in San Pablo Bay during the winter and spring to support sustainable populations of Bay species.

5. **Provide Sufficient Transport Flows** at the proper times to move larval and juvenile fish from spawning habitats to nursery habitats in the Delta and Bay.

a) **Increase the Transport of Young Fish from the Delta to Suisun Bay** nursery areas to support sustainable populations of important estuarine species.

b) **Increase the Transport of Young Fish Through the Delta** to the ocean to support sustainable populations of estuarine and anadromous fish species.

c) **Reduce the Transport of Young Fish from North to South across the Delta** and the entrainment of fish in the Delta to increase the survival and abundance of estuarine and anadromous species.

d) **Reduce the Blockage of and Alterations to Transport Flows** by local structures.

6. **Reestablish Appropriate upstream and downstream movement** of anadromous and estuarine fish.

a) **Enhance Upstream Migration of Adult Salmonids** through the Delta.

b) **Increase Successful Outmigration of Juvenile Fish through the Delta.**

c) **Enhance Upstream Migration of Adult Estuarine Fish into the Delta and River Spawning Areas.**

7. **Improve the Productivity of the Aquatic Habitat Food** Web ~~Chain~~ to support sustainable populations of desirable fish (and other) species.

a) **Reduce Entrainment** of biological productivity throughout the aquatic food web ~~chain~~.

b) **Reduce Concentrations of Toxicants** in the water column and in sediments.

c) **Reduce the Effects of Introduced Species** on ecosystem productivity and in competing with desirable species for habitat.

d) **Increase the Residence Time of Water in Delta Channels** to increase plankton productivity and reduce undesirable algal-mat growth in the Delta.

e) **Increase the Input of Nutrients** from wetland and riparian habitats to aquatic habitats.

f) **Reduce Salinity Levels** in Delta aquatic habitats.

g) **Increase Flows of Freshwater** into the Delta ~~Estuary~~.

~~h) Increase Amount and Quality Shallow Water Habitats in the Estuary.~~

8. **Reduce Concentrations of Toxic Constituents and Their Bioaccumulation** to eliminate their adverse effects on populations of fish and wildlife species.

a) **Reduce the Concentrations of Pesticide Residues** in Delta water and sediments.

b) **Reduce the Concentrations of Hydrocarbons, Heavy Metals, and other Pollutants** in Delta water and sediments.

B. **Improve and Increase Important Wetland Habitats** so that they can support the sustainable production and survival of wildlife species.

1. **Increase the Amount of High Quality Brackish Tidal Marsh Habitat** to better support sustainable populations of native wildlife species in the Delta.

a) Modify salinity levels in Brackish Tidal Marshes to **Improve their Vegetation Composition.**

b) **Increase the Areal Extent of Brackish Tidal Marsh Habitats**.

~~c) Restore Appropriate Salinity Levels in brackish tidal marshes to enhance forage productivity and habitat suitability for some native species.~~

c) **Improve the Connectivity** Between Brackish Tidal Marsh Habitats **and Their Supporting Habitats** such as aquatic habitats and riparian woodlands and adjacent uplands.

2. **Increase the Amount of High Quality Freshwater Marsh Habitat** to better support sustainable populations of native wildlife species in the Delta.

a) **Restore Appropriate Salinity Levels** in freshwater marsh habitat in the Delta to enhance forage productivity and habitat suitability for some native species.

b) **Increase the Areal Extent** of freshwater marsh habitats.

c) **Improve the ~~Juxtaposition~~ Connectivity** of freshwater marsh habitats to provide corridors for population movement and genetic exchange for dependent species.

d) **Reduce the Vulnerability** of existing freshwater marshes to levee failure.

3. **Increase the Amount of High Quality Riparian Woodland Habitat** in the Delta to better support sustainable populations of native wildlife populations.

a) **Increase Amounts of Riparian Habitat Structure** for nesting near foraging areas for some native bird species.

b) **Reduce the Fragmentation** of riparian woodland habitat patches to provide corridors for population movement and genetic exchange for dependent species.

c) **Increase the Areal Extent** of riparian woodland habitats.

d) **Improve the Connectivity** Between Riparian Woodlands and Their Supporting Habitats such as aquatic habitats and brackish marsh habitats.

4. **Increase the Amount of Breeding Waterfowl Habitat** to better support sustainable populations of dabbling ducks.

a) **Increase the Amount of High Quality Brood Habitat** near nesting habitat for dabbling ducks.

b) **Increase the Amount of High Quality Nesting Habitat** near brood habitat for dabbling ducks.

5. **Increase the Amount of Wintering ~~Waterfowl~~ Wildlife Habitat** for foraging and resting to better support sustainable populations of wintering waterfowl.

a) **Increase** supplies of suitable forage such as **Waste Grain** on agricultural lands.

b) **Increase**the amount of **Resting Areas** near foraging areas for wintering ~~waterfowl~~ wildlife.

c) **Increase** the amount of high quality **Foraging Areas** (e.g. freshwater marsh and brackish water marsh) for wintering ~~waterfowl~~ wildlife.

d) **Reduce the Vulnerability** of some existing Wintering ~~Waterfowl~~ Wildlife Habitats to levee failures.

6. **Increase the Amount of ~~Wintering~~ Managed Permanent Pasture Habitat for ~~Greater Sandhill Cranes~~** to better support wintering crane populations. ~~sustainable populations.~~

a) **Increase** the amount of **Foraging Habitat** in proximity to roosting habitat.

b) **Increase** the amount of **Roosting Habitat** in proximity to foraging habitat.

~~7. **Improve the Connectivity Among Wetland Habitats** to provide corridors for population movement and genetic exchange.~~

7. **Increase Flood Plains and Associated Riparian Habitat** to improve diversity and sizes of fish and wildlife populations.

a) **Increase** suitable flood plains to improve the availability of **Temporary Flooded Spawning Habitat** for fish.

b) Improve narrow restricted channels to **Reduce the Risk of Catastrophic Losses** of wildlife habitat from levee failure.

B-000681

C. **Increase population health and population size** of Delta species to levels that assure sustained survival.

1. **Contribute to the recovery** of threatened, endangered or species of special concern.

2. **Increase populations** of economically important species.

3. **Increase populations** of prey or food species.

Draft

WATER QUALITY PROBLEMS

Water quality problem statements are developed around five beneficial use categories and are presented in the attached outline and tree graphic. These categories represent the primary beneficial uses requiring ~~adequate~~ improved water quality from the Delta: drinking water, agriculture, industry, recreation, and ecosystems. **Drinking water** quality problem statements are tied to health effects, aesthetics, treatment costs and difficulty, and federal and state drinking water regulations. **Agricultural water quality** problem statements relate to economic productivity, crop choice, and operational difficulties. **Industrial water quality** problem statements relate to treatment and production costs and operational difficulties. **Recreational water quality** problem statements relate to health risk and aesthetics. **Ecosystem water quality** problems are addressed under Ecosystem Quality.

Water Quality
Problem Statements

The water quality in the ~~Bay-~~Delta must be managed ~~is insufficient~~ to meet the beneficial uses of the Delta water.. At times, drinking water quality standards have not been met and contaminants have been found in some fish and wildlife species triggering public health warnings.

The major problems can be categorized as follows:

A. Water quality is often inadequate or is perceived as inadequate for **Drinking Water needs.**

1. Certain water quality parameters present in Delta water have or may have **Adverse Human Health Effects**.

2. Certain water quality parameters present in Delta water have or may have **Adverse Aesthetic Effects**, in particular concerning taste, odor, and appearance.

3. Levels of certain water quality contaminants may increase the **Cost of Treating** Delta water in order to meet the existing drinking water quality standards.

4. **Fluctuating Raw Water Quality** increases the difficulty of water treatment plant operations.

5. **Stricter Future Regulations** may be difficult to meet with the existing treatment techniques and raw water quality.

B. Delta water quality is often inadequate for **Agricultural** needs.

1. Certain water quality contaminants may reduce **Agricultural Economic Productivity** by reducing crop productivity, the choice of suitable crops, or by increasing costs.

2. Certain water quality contaminants such as sediments may result in **Operational Difficulties.**

~~3. **Salinity in agricultural water increases salinity of drainage water to other surface and groundwater supplies. (Delete based on recent developed performance measures. This is realy a cause - not a problem.**~~

C. Delta water quality is often inadequate for some **Industrial** needs.

1. Certain water quality contaminants may increase **Cost of Treatment and Production** for industrial users or even prevent user from discharging effluent.

2. **Fluctuation of Raw Water Quality** increases the difficulty of plant operation for industrial users.

D. Delta water quality is often inadequate for water **Recreational** needs.

1. Certain water quality contaminants may pose an **Increased Health Risk** to recreationists.

   a. **Body Contact Recreational Activities** in the Delta may increase the risk of exposure to contaminants.

   b. **Consuming Fish** caught in the Delta may increase the risk of exposure to contaminants.

2. Certain water quality parameters may adversely impact **Aesthetic Conditions** in the Delta, in particular taste, odor and appearance.

~~3. Water quality regarding **Nuisance Vegetation** may impede recreational boating and other on-water recreation. **Delete based on WS #2 comment, already covered in ecosystem. Herbicide is a cause not a problem.**~~

E. Water quality is often inadequate for **Environmental** needs for the Bay-Delta system. (see Ecosystem Quality)

Water Quality
Objective Statements

Provide good ~~adequate~~ water quality for all beneficial water users.

The major objectives can be categorized as follows:

A. Provide good ~~adequate~~ water quality in Delta ~~w~~Water exported for **Drinking Water** needs.

1. **Reduce** the level of water quality parameters of **Concern to Human Health** in ~~raw~~ water supply or treat to reduce concern.

2. **Reduce** the water quality parameters that cause **Aesthetic Effects**, in particular concerning taste, odor and appearance in ~~raw~~ water supply ~~or treat to reduce effects.~~

3. **Minimize the Cost of Treating** Delta water and continue to meet the existing drinking water quality standards.

4. **Minimize the Fluctuation of Raw Water Quality** to improve water treatment plant operation.

5. **Improve Raw Water Quality** and/or treatment to comply with stricter future drinking water regulations.

B. Provide ~~adequate~~ good Delta water quality for **Agricultural** use.

1. Improve or manage water quality to **Maintain or Improve Agricultural Economic productivity** by reducing water quality contaminants that reduce crop productivity on lands receiving Delta water, reduce cropping choices, or increase costs.

2. Improve water quality or recommend change in irrigation technology to **Minimize Operational Difficulties**.

~~3. **Reduce Salinity Levels** to minimizethe risk of polluting other surface and groundwater supplies from agricultural drainage.~~

C. Provide ~~adequate~~ good Delta water quality for **Industrial** use.

1. **Reduce Industrial Treatment and/or Production Costs**.

2. **Minimize the Fluctuation of Raw Water Quality** to improve industrial plant operations.

D. Provide ~~adequate~~ good Delta water quality for water **Recreational** use within the Delta.

1. **Reduce Health Risk** to recreationists.

   a. **Reduce Health Risk Associated with Body Contact** recreational activities.

   b. **Reduce Health Risk Associated with Consuming Fish** caught in the Delta.

2. **Improve Aesthetic Conditions** in the Delta, in particular taste, odor and appearance.

~~3. **Reduce Occurrence of Nuisance Vegetation** that may impede recreational boating.~~

E. **Provide ~~adequate~~ improved Delta water quality for Environmental needs.** (see Ecosystem Quality)

Draft

VULNERABILITY OF BAY-DELTA SYSTEM FUNCTIONS PROBLEMS

Many of the "problems" commonly listed for the vulnerability of Bay-Delta system functions are actually causes of problems. For example, poor levee construction, ~~poor~~ inadequate maintenance, the lowering of the islands due to subsidence, levee instability, and lack of resistance to earthquake and floods are causes of the problems tied to levee failure. Four major problems for the vulnerability of Bay-Delta system functions due to potential failure of Delta levees were identified. Inundation could result in loss of land use, infrastructure and associated economies, damage ecosystem habitats, endanger water supply reliability, and reduce water quality ~~damage infrastructure~~ in the Delta.

Draft

Vulnerability of Bay-Delta Systems Functions

Problem Statements

The Bay-Delta system is subject to physical damage, loss of productivity, and an unacceptably high risk of catastrophic inundation of Delta islands due to potential levee failure from earthquakes, floods, and physical condition. ~~Inundation would result in~~ Loss of agricultural production, damages to wildlife habitat and infrastructure, ~~and could result in~~ can result due to sudden catastrophic inundation of Delta islands. Continuing need for levee maintenance and. Increased salinity intrusion into the Delta adversely affecting habitat and water supply operations. Continuing need for levee maintenance and periodic levee failures indicate that the vulnerability of Bay-Delta functions ~~risk of inundation~~ is unacceptably high. ~~Other disruptive events could include losses from toxic spills.~~ The major problems are:

A. **Existing Agricultural Land Use, ~~and~~ Economic Activities, and Infrastructure in the Delta are at Risk from Gradual Deterioration of Delta Conveyance and Flood Control Facilities as well as Sudden Catastrophic Inundation of Delta Islands.** Seepage, erosion, and overtopping of levees, and subsidence of Delta islands and the adjacent levees disrupts framing operations as well as other land uses, and infrastructure and requires constant maintenance efforts. Inundation of one or more islands in the Delta can ~~would~~ disrupt farming operations and other land uses either permanently or for a significant period of time until repairs could be made. Inundation of roads, electric power lines, telephone lines, gas mains, and other infrastructure can cause lengthy breaks in service. In addition, several State highways and many Delta roads run along levees that are vulnerable to collapse due to erosion, seismic events or structural failure. Major water pipelines also pass through the Delta and are at risk of failure. Even if they survive the initial effects of inundations, long-term inundation would make continued maintenance and repair much more difficult.

1. **Reduction of Agricultural Productivity and Damage to Infrastructure** can result from seepage, and overtopping of the levees. Subsidence of the Delta island peat soils and foundations places additional pressure on surrounding levees and increases the risk of failure.

2. **Long-term Loss of Agricultural Productivity and Infrastructure** can result from catastrophic island inundation.

B. **Water Supply Facilities and Operations in the Delta are at Risk from Increased Salinity Intrusion, which can result from Sudden,Catastrophic Inundation of Delta Islands.** Inundation of one or more key islands in the western and central Delta can allow ~~would accelerate~~ salinity to intrude further ~~intrusion~~ into the Delta. This salinity intrusion can ~~could~~ result in a need to halt In-Delta use as well as ~~stop~~ export pumping, perhaps for extended periods, until flushing flows released from upstream reservoirs lower salinity in the Delta water supply to acceptable levels. Stored water supplies in upstream reservoirs could be seriously depleted. ~~Other disruptive events that could require stopping export pumping and release of increased flushing flows include risk from toxic spills.~~

1. In-Delta water supply can interrupted as a result from catastrophic island inundation and resultant salinity intrusion. (See Water Supply Problem Statement.)

2. Export water supply can be interrupted as a result from catastrophic island inundation and resultant salinity intrusion. (See Water Supply Problem Statement).

~~C. Existing Infrastructure in the Delta is at Risk from Catastrophic Inundation of Delta Islands. Inundation of roads, electric power lines, telephone lines, gas mains, and other infrastructure could cause lengthy breaks in service. In addition, several State highways and many Delta roads run along levees that are vulnerable to collapse due to overtopping, seismic events, or structural failure. Major water pipelines also pass through the Delta and are at risk of failure. Even if they survive the initial effects of inundation, long-term inundation would make continued maintenance and repair much more difficult.~~

C. **Water Quality in the Delta is at Risk from Increased Salinity Intrusion which can result from Sudden Catastrophic Inundation of Delta Islands.** Inundation of one or more key islands in the western and central Delta can allow salinity to intrude further into the Delta. This salinity intrusion can result in degraded Delta water quality, perhaps for extended periods, until flushing flows released from upstream reservoirs can lower salinity in the Delta water supply to acceptable levels. Stored water supplies in upstream reservoirs could be depleted.

1. Water quality for some In-Delta beneficial uses can be degraded as a result of catastrophic island inundation and resultant salinity intrusion. (See Water Quality Problem Statement).

D. **The Existing Delta Ecosystem is at Risk from Gradual deterioration of Delta Conveyance and Flood Control Facilities as well as Catastrophic Inundation of Delta Islands.** Seepage, erosion, and overtopping of levees, and subsidence of Delta islands and adjacent levees requires constant maintenance efforts which can damage valuable habitat and/or reduce its productivity. Significant habitat for terrestrial species can ~~would~~ be severely damaged by inundation of one or more Delta islands. If the inundation continued for extended period, survival of flora and fauna dependent on the habitat can ~~would~~ be critically reduced. In addition, as described in B above, salinity intrusion into the Delta can ~~would likely~~ increase causing significant impacts to aquatic freshwater habitat.

1. **Reduction of Ecosystem Productivity** and damage to valuable habitat can result from seepage, erosion, and overtopping of levees. Subsidence of the Delta island peat soils and foundations providing this ecosystem productivity places additional pressure on surrounding levees and increases the risk of failure.

2. **Long-term loss of valuable Aquatic and Terrestrial habitat** can result from catastrophic island inundation and resultant salinity intrusion.

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Vulnerability of Bay-Delta Systems Functions

Objective Statements

Manage ~~Reduce~~ the risk to land use and associated economic activities, infrastructure, water supply, water quality ~~infrastructure,~~ and the ecosystem from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands through risk assessment and planning measures which reduce physical damages and loss of productivity.

A. **Reduce manage the risk to existing land use ~~and~~ associated economic activities and infrastructure** from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.

1. Manage the reduction of agricultural productivity and damage to infrastructure from seepage and overtopping of the levees. Manage subsidence of the Delta island peat soils and foundations which places additional pressure on surrounding levees and increases the risk of failure.

2. Manage the risk of long-term loss of agricultural productivity and infrastructure which can result from sudden catastrophic inundation.

B. **Reduce manage the risk to water supply facilities and operations** in the Delta from catastrophic inundation of Delta islands. ~~or other disruptive event such as a toxic spill.~~

1. Manage the risk of interruption of In-Delta water supply which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Supply Objective Statement).

2. Manage the risk of interruption of Export water supply which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Supply Objective Statement).

C. ~~Reduce~~ **Manage the risk to ~~existing infrastructure~~ water quality** in the Delta from catastrophic inundation of Delta islands.

1. Manage the risk of degradation of In-Delta water quality which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Quality Objective Statement).

2. Manage the risk of degradation of Export water supply which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Quality Objective Statement).

D. ~~Reduce~~ **Manage the risk to existing Delta ecosystem** from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.

1. Manage the risk of reduction of Ecosystem Productivity and damage to valuable habitat which can result from seepage, erosion, and overtopping of levees. Manage subsidence of the Delta island peat soils and foundations providing this ecosystem productivity which places additional pressure on surrounding levees and increases the risk of failure.

2. Manage the risk of long-term loss of valuable Aquatic and Terrestrial habitat which can result from sudden catastrophic inundation and the resultant salinity intrusion.